

APPENDIX C

MAJOR GEOLOGIC FORMATIONS WITHIN THE PROPOSED ACTION AND ALTERNATIVES REGION OF INFLUENCE

PROPOSED ROUTE

Griffith Canyon Quadrangle

TI-Lousetown Formation (11.12±0.03 Ma): Dark-gray to dark-brown-weathering, dark-gray olivine basalt flows that dip west and may be of a postulated shield volcano centered on Spanish Springs Peak in the Pah Rah Range to the West.

Qoa-Older Alluvial fan deposits (Quaternary, Holocene to Pleistocene period): Alluvial fan remnants with moderately to deeply incised surfaces, primarily consisting of semi-consolidated pebbly to bouldery arkosic sand derived from Hungry Ridge.

Qa-Alluvium (Holocene): Holocene alluvium, restricted to valley bottoms and localized portions of arkosic, sand and gravelly sand deposited as sheetwash and wash alluvium in Holocene to modern channels or as broad, low-gradient alluvial plains. Locally contains abundant medium sand reworked from older Aeolian deposits. No soil development except on very localized Holocene terraces, where soil is weak, 10-15 cm, and gray-brown. Includes undifferentiated alluvial fan and colluvial deposits in upland areas.

Kmr-Monzodiorite and diorite of Rocky Ridge (recent cretaceous): Commonly medium-gray, porphyritic to subhedral granular plutonic igneous rock consisting of euhedral gray plagioclase; interstitial, fine-grained, anhedral alkali feldspar and quartz; distinctive, thin euhedral books of biotite; green hornblende; and accessory sphene and iron-titanium oxides.

Ts-Sedimentary rocks of Hungry Valley (Miocene Period): White, very light gray, very pale-orange, and greenish-yellow, tuffaceous, coarse to fine volcanoclastic to feldspathic or arkosic bedded sandstone, pebbly sandstone and conglomerate interbedded with tuffaceous siltstone. Locally cemented with calcite or, rarely, iron oxides. Lies with angular unconformity or nonconformity on most older Tertiary and pre-

Tertiary rocks. Locally overlain by very thin veneer pediment deposits and lag. Thickness probably <100 m on Hungry Ridge; thicker below alluvium in valley areas.

Reno NE Quadrangle

Mzgd-Granodiorite (Mesozoic): Light to dark-gray, fine to coarse-grained, equigranular to porphyritic hornblende-biotite granodiorite. Moderate to highly fractured and faulted. Cut by basalt and aplite-pegmatite dikes and quartz and epidote veins. Highly resistant to weathering; forms blocky, jagged, outcrops.

Ts- Tertiary sediments: Cream to gray to pale-green, thick interbedded alluvial and fluvio-lacustrine basin-fill sediments. Included interbedded, unconsolidated to moderately well consolidated arkosic sandy gravel, gravelly sand, granular to very fine grained sand, tuffaceous sandstone, slightly diatomaceous siltstone, and thin lenses of air-fall tuff. Commonly highly dissected and overlain by veneer of pebbly sand or lag gravel. Probably equivalent in age to sandstone of Hunter creek (Bonham and Bingler 1973).

Qag- Old alluvial gravels (Quaternary-Tertiary): Dark-reddish-gray, very poorly sorted sandy cobble to boulder gravel. Predominantly Tertiary volcanic clasts (minor granitic clasts). Strongly developed soil with duripan.

Qva- Volcanic alluvium (Quaternary): Brownish-red to dark-yellowish-brown, very poorly sorted pebbly muddy sand to muddy gravel and bouldery gravelly sand. Moderately dissected. Well developed argillic soil. Forms a thin veneer over TS formation.

Tk-Kate Peak Formation (Tertiary): Gray to reddish-gray, porphyritic to glomeroporphyritic hornblende-biotite andesite flows. Vuggy, highly resistant to weathering. Forms rugged bouldery outcrops.

Qfg- Alluvial fan deposits (Quaternary): Gray-brown to yellowish-brown, moderately well sorted to very poorly sorted granular coarse sand to sandy boulder gravel; predominantly arkosic. Forms broad gently sloping, relatively undissected fan surfaces and steeper colluvial slopes with cambic soil development.

Qa- Sheetwash, stream channel, and other Holocene alluvium: Gray to yellowish-brown, poorly sorted cobbly to pebbly sand and muddy sand to moderately well sorted fine to coarse sand; predominantly arkosic. Striped pattern indicates gravelly alluvium derived from Tertiary volcanic rocks.

Qws- Windblown sand (Holocene): Yellowish-brown to tan, moderately well sorted, arkosic medium sand. Forms stabilized dunes and actively accumulating deposits.

Qoa- Old alluvium (Pleistocene): Tan to brown, very poorly sorted, moderately consolidated pebbly silt to unconsolidated gravelly sand and muddy sandy pebble gravel. Occurs as deeply dissected fan remnants. Strongly argillic soil with weak duripan.

Qbg- Granitic boulder alluvium (Pleistocene): Gray to brown, very poorly sorted sandy boulder gravel. Well developed argillic soil.

Qfp- Axial-stream floodplain deposits (Holocene-Pleistocene): Brown to yellowish-brown, well-sorted slightly sandy mud to fine sand.

Reno NW Quadrangle

Qsw-Sheetwash alluvium (Holocene): Thin deposits of moderately to poorly sorted medium to fine sand, granular coarse to medium sand, and sandy pebble gravel. Color and texture closely related to local bedrock source areas.

Qoa- Older fan alluvium (Pleistocene): Deposits of dark yellowish-brown and gray, cobbly to pebbly very coarse sand, and sandy pebble to boulder gravel. Locally exposes and eroded along basin margins.

Ts-Lacustrine and alluvial sediments: Thick basin-fill deposits of grayish-orange to pale-brown, coarse to medium sand, granular sand, siltstone, silty to pebbly sandstone, and minor sandy pebble conglomerate, very thin-bedded ash and diatomite. Sediments are generally unconsolidated and bedding is usually indistinct. In part includes much younger alluvium near the surface. Probably equivalent in age to the Sandstone of Hunter Creek (Bonham and Bingler 1973).

Qb- Beach deposits (Pleistocene): Lakeshore deposits of pale yellowish-brown to pale yellowish-white, granular medium to coarse sand, sandy pebble gravel, and granule gravel.

Qs- Flood-plain deposits (Holocene): Pale to dark yellowish-brown and pale brownish-white beds of moderately to well-sorted fine to very fine sand, and poorly sorted sandy clay and mud.

Qfb- Beach Deposits (Pleistocene): Forebeach deposits of pale yellowish-brown to grayish-orange, pebbly to granular coarse to medium sand, and sandy granule gravel. Grades laterally into beach deposits.

Qcd- Clay Dunes (Holocene): Windblown granular aggregates of dark yellowish-brown clay and slightly sandy silty clay.

Qpf- Alluvial-fan deposits of Peavine Mountain (Pleistocene): Semi-lithified, poorly bedded and poorly sorted reddish-brown and dark yellowish-orange, slightly muddy sandy pebble to cobble gravel. Clasts are composed predominantly of white altered andesite.

Patrick Quadrangle*

CALLE DE LA PLATA ALTERNATIVE (SAME AS PROPOSED WITH ADDITION OF THE FOLLOWING):

Reno NE Quadrangle

Tvt- Vitric tuff (Oligocene): Cream to yellowish-tan to pale-purple rhyolitic to thiodacitic vitric to vitric-crystal tuff. Includes a variety of poorly to densely welded tuffs with sanidine, sanidine-smoky quartz, plagioclase-biotite, or biotite phenocrysts in a devitrified, locally pumiceous, fine-grained matrix. Forms resistant, knobby outcrops where densely welded.

Tpt-Pumice tuff (Oligocene): Pale to dark-gray, very pumiceous vitric-crystal tuff. Usually poorly welded, fine- to medium-grained, glassy, shard-rich ash with abundant pumice lapilli; phenocrysts of sanidine, quartz, few lithic fragments. Includes densely welded peritic vitrophyre. Easily weathered, rarely crops out.

Tnh-Nine Hill Tuff (Miocene-Oligocene): Reddish-purple to pale-orangish-red, pumiceous, rhyolite vitric tuff. Densely welded, devitrified, with stretched and flattened pumice lapilli. Vugs with vapor-phase crystallization products common. Forms distinct ridges.

Qp-Playa deposits (Holocene): Light-brown to brown, moderately well sorted slightly sandy to granular mud with interbedded fine sand and silt.

Qcd- Clay dunes (Holocene-Pleistocene): Brown to gray-brown, loose, moderately well sorted muddy fine sand and fine to medium sand-size aggregates of clay derived from playa and lake deposits. Stabilized and breached by recent stream channels.

QI-Deposits of late Pleistocene Lake Lemmon Lake deposits: Pale-yellow to gray, well sorted slightly sandy silt to clay. Flat-lying; cut by recent stream channels.

Patrick Quadrangle*

FOOTHILL ALTERNATIVE (JUST FOOTHILL SEGMENT ADDITIONAL DEPOSITS)

Griffith Canyon Quadrangle

Qta-Late Tertiary/early Pleistocene alluvial and alluvial fan deposits: Moderately to strongly consolidated alluvial gravels and alluvial fan sediments. Rarely exposed, these deposits are well bedded, clean, and tectonically deformed. Gravel units contain small quantities of rock types exotic to Hungry Ridge. Alluvial fan sediments of this age are restricted to the southeastern side of Hungry Ridge. Deposits are poorly sorted and arkosic, with cobbles and boulders of various intrusive rock types. These deposits have been modified by pediment erosion and are poorly exposed in most areas. Soils associated with these sediments are deeply eroded in all available outcrops. Alluvial fan facies post date the gravel-facies of this map unit.

Qpgo-Older pediment deposits and/or surface: These deposits are associated with late and middle Pleistocene and older, deeply dissected pediment surfaces cut into older bedrock and sediments.

Reno NE Quadrangle

Qfgo-Older Alluvium, colluvium, and decomposed granite (Pleistocene): Grayish-tan to reddish-brown, very poorly sorted muddy coarse sand and sandy pebble gravel to gravelly sand; arkosic, unconsolidated. Strongly argillic soil overlaying weak duripan developed locally.

Qgv-Old gravelly alluvium (Pleistocene): Tan to reddish-brown, very poorly sorted cobbly muddy fine sand to gravelly sand. Predominantly arkosic with some rounded carbonate-coated volcanic pebbles and cobbles (probably derived from Tg). Poorly indurated with a strongly developed soil profile.

Patrick Quadrangle*

NORTHERN ROUTE (STARTING FROM THE EDGE OF THE GRIFFITH CANYON QUADRANGLE)

Griffith Canyon Quadrangle

Kgr-Granite (<85 ma): Very light-gray, pinkish-gray-weathering, medium grained, equigranular to locally porphyritic rock consisting of plagioclase, locally euhedral alkali feldspar, anhedral to rounded quartz,

biotite, iron-titanium oxides, trace zircon, and rarely, sphene. Alkali feldspar locally as poikilitic megacrysts and muscovite is locally present as separate crystals or intergrown with biotite. Weathers to corestones and grus. Appears to intrude Kmr and Kgd, where it is locally aplitic. Similar to Kqm of the local Reno and Reno NE Quadrangles (Bongham and Bingler, 1975; Cordy 1983).

Kgd-Granodiorite (92.5±0.4 ma): Light-to medium-gray, medium-grained, subhedral granular to rarely porphyritic, plutonic igneous rock consisting of plagioclase, quartz, commonly interstitial alkali feldspar, and subequal amounts of biotite and green hornblende, with accessory sphene and magnetite-ilmenite. Honey-colored sphene is ubiquitous and distinctive. A few hornblende phenocrysts are up to 1 cm long. Possibly a phase of or closely related to Kmr.

Frazer Quadrangle

Qa- Active alluvium (Holocene): Annually active cobble, gravel and sand deposits in washes, locally with boulders in proximal reaches; occupies channels inset up to 20 m and that flow across the basin floor; anastomosing bar and swale topography is generally ubiquitous. Deposits range from moderately to sorted to poorly sorted, poorly to moderately stratified, and are generally non-indurated. Clasts are angular to subrounded.

Qtls- Landslide deposits (Pliocene/Middle to early Pleistocene): Predominantly deposits resulting from rock avalanche, debris flow, and rotational slump. Chaotic mixtures of sand, cobbles, boulders, and very large blocks of rock; 1-2 m boulders are common and blocks up to 12 m are found in rock avalanche deposits up to several km from their origin. Individual deposits are predominantly monolithic but some deposits are composites of more than one flow or avalanche. Deposits are commonly deeply eroded and clearly older than most Quaternary units. Erosion has removed or obscured primary morphologic characteristics of most of the deposits, and in most cases exact source areas cannot be determined. Rock material in the landslide deposits consists primarily of Kmr (Griffith Canyon Canyon Quadrangle Garside and Niles 1998), Tws, Tnh, Tcs, and Tpu. Granitic and ash-flow tuff units such as these may be susceptible to mass wasting because of formation of boulder-mantled slopes of corestones.

Tws- Tuffs of Whiskey Spring (Oligocene): Sequence of several commonly moderately welded rhyolitic ash-flow tuffs. Usually light-brown- or reddish-brown-weathering, pale-orange to light-brown rocks containing phenocrysts of play-fractured glassy sanidine, plagioclase, and biotite, with sparse to trace quartz. Moderately welded ash-flow tuffs commonly contain phenocrysts of sanidine plagioclase, and biotite. Lithic fragments include metasilstone, granodiorite, intermediate lava, and ash-flow tuff similar to the Whiskey Spring. Basal vitrophyre locally; in places, a “nubbly” weathering surface is developed on rock outcrops by closely spaced joints in devitrified vitrophyre. Deposited on a locally irregular erosion surface on pre-Tertiary rocks.

Tal- Andesite lahars (Miocene): Reddish-brown-weathering, medium-gray, massive to very rarely crudely layered lahars consisting of blocks and clasts of light to dark gray, glassy to microcrystalline porphyritic andesite in a light gray matrix of finer andesitic material. Commonly matrix supported by monolithic, although blocks of older ash-flow tuff up to 10 m in length are found locally near the base. Andesite clasts are hiatal to locally seriate, containing phenocrysts of plagioclase ± basaltic hornblende ± pyroxene ± biotite in a fluidal groundmass of fine plagioclase and pyroxene.

Qa₃- Early to middle Pleistocene alluvium: Deposited on alluvial fans and some fluvial terraces; deposits consist of sands, gravels, and cobbles with occasional boulders in the proximal parts of fans; deposits are poorly to moderately sorted, moderately to poorly stratified and are moderately to well indurated. Landforms made on Qa₃ deposits are notably eroded, some into ballenas. Surfaces on Qa₃ deposits are smoothed and have poorly to moderately developed pavements, and have well-developed drainages. Soil development in Qa₃ deposits usually consist of a reddened, sticky clayey argillic horizon up to 0.5 m thick, and a lower calcic horizon with up to stage III CO₃ development and/or silica pan.

Ts- Sedimentary rocks (Miocene): White, very light-gray, very pale-orange, and greenish-yellow, tuffaceous, coarse to fine fluvial and lacustrine volcanoclastic to feldspathic and arkosic bedded sandstone, pebbly sandstone and conglomerate interbedded with tuffaceous siltstone. Sandstone units are commonly poorly sorted and immature with subangular grains. Pebbles in sandstone and conglomerate beds consist of rhyolitic ash-flow tuffs or vesicular andesite. Contains several massive beds of andesitic lacustrine fine lapilli tuff. Sandstones are locally cemented with calcite or, rarely, iron oxides; ash in some tuffaceous beds is converted to zeolite minerals. Rare large mammal and fish bones are found in the unit. Lies with angular unconformity or nonconformity on most older Tertiary and pre-Tertiary rocks.

Qa₁- Young alluvium (Holocene): Alluvium generally deposited on alluvial fans with some channel deposits, basin alluvial deposits, and active alluvium; deposits consist of sand, gravel, and cobble deposits with occasional boulders in the proximal parts of fans, and generally gravelly, silty sands in the mid to distal parts of the fans; deposits are poorly to moderately sorted, poorly to well stratified, and non-indurated to poorly indurated. Surfaces on Qa₁ deposits commonly have depositional microtopography including bar and swale morphology, and broadly undulating and pocketed surface morphology. Soil development ranges from no distinct development to generally A/C profiles. Some soils in these deposits have up to 0.2 m, colored cambic horizons.

Beddell Flat Quadrangle

Ts- Tertiary Sedimentary Rocks: Lacustrine and fluvial conglomerate, sandstone, and tuffaceous siltstone and shale. Predominantly white to light gray and commonly poorly exposed. Thin-bedded to massive arkosic sandstone makes up a major part of the unit in some areas. May be covered with a thin lag gravel of Qpg.

Mzgd- Granodiorite of Golden Valley (Cretaceous): Gray hornblende-biotite granodiorite, equigranular to porphyritic, medium grained. Resistant to weathering, forming blocky to spheroidal corestone outcrops surrounded by gus. On Hungry Mountain, locally contains dark-greenish-gray, cognate inclusions of microphaneritic granodiorite porphyry. Probably part of a Cretaceous pluton dated at 91 Ma west of Peavine Peak, 25 km to the southwest (Bell and Garside 1987). Stipple pattern denotes areas of greisen-like alteration in the vicinity of titanium prospects. Muscovite from the eastern altered area was K-Ar dated at 86.7±0.03 Ma (McKee 1990).

Mzap- Aplite and pegmatite dikes (Cretaceous): Long, commonly 1-2 m wide, high-angle aplite or aplite/pegmatite dikes, consisting predominantly of quartz and alkali feldspar. Light gray to pink; dikes commonly form long, narrow, linear ridges in more easily eroded granitic wall rock. The dikes cut both Mzqm and Mzqd, but are much more common in Mzqm, and may be related to that phase of magmatism. Most of the dikes occur in a northerly striking swarm on the west flank of Warm Springs Mountain.

Qf- Alluvial-fan deposits (Holocene-Pleistocene): Very poorly to moderately sorted cobbly and pebbly sand, unconsolidated to partially consolidated and predominantly arkosic. Consists of relatively undissected remnants overlying unit T's west of Freds Mountain and east of Hungry Mountain.

Ql- Lake Deposits (Pleistocene): Lacustrine silt and clay, and beach bar and forebeach deposits of fine to coarse sand. Deposited in a small late Pleistocene lake in Antelope Valley (Cordy 1985).

Qa- Alluvial-plain and undifferentiated alluvial deposits (Holocene-Pleistocene): Unconsolidated sand and gravelly sand, predominantly arkosic. Sheetwash, sidestream, and wash alluvium in predominantly Holocene to modern channels or as broad, low-gradient alluvial plains.

Reno NE Quadrangle

Qsu- Undifferentiated sand (Holocene): Yellowish-brown to tan, moderately sorted, arkosic medium to fine sand. Forms stabilized dunes and actively accumulating deposits.

Mzfg- Foliated granitic rocks (Mesozoic): Pinkish-to dark-gray, fine-to coarse-grained, equigranular, weakly foliated to gneissic diorite to granodiorite.

Mzqm- Quartz monzonite (Mesozoic): Pink to pale-gray, massive, medium to coarse-grained, equigranular to porphyritic quartz monzonite to granite. Includes extensive aplite, graphic granite, quartz veins, and pegmatite dikes. Generally deeply weathered; forms low, rounded outcrops.

Reno NW Quadrangle

Qfs- Alluvial fan deposits (Holocene): Pale to dark yellowish-brown, slightly granular to granular coarse sand, and slightly pebbly to moderately sorted medium sand.

Qpg- Pediment gravel (Pleistocene): Thin sheets of pale-brown and pale yellowish-brown, sandy granule to cobble gravel, and pebbly very coarse sand. Clasts comprise a wide range of lithologic compositions and locally form a desert pavement.

Patrick Quadrangle*

SOUTHERN ALTERNATIVE

Griffith Canyon Quadrangle

No new deposits

Vista Quadrangle

Qagy- Alluvial fan deposits of the Pyramid Lake Highway (Holocene): Brown, granitic, pebbly sand. Soils have A-C to cambic B profiles.

Reno NE Quadrangle

Mzv- Peavine sequence (Mesozoic): White to dark-gray rhyolitic to andesitic metavolcanic rocks. Commonly porphyritic; copper mineralization locally. Forms resistant, knobby outcrops that are highly fractured to sheared in mineralization areas.

Tg- Tertiary gravels (Pliocene): Gray to brown, very poorly sorted, moderately indurated, stratified bouldery cobble gravel to sandy gravel with thin, interbedded lenses of volcanic sandstone. Sixty percent clasts of Tertiary volcanic rocks and basalt; forty percent highly weathered to disintegrated granitic clasts. Well developed duripan.

Qlf- Landfill (Holocene).

Reno Folio Quadrangle

Mzgd- Granodiorite (Mesozoic): Gray hornblende-biotite granodiorite. Deuteric alteration has commonly formed actinolite and chlorite from hornblende and biotite. Deeply weathered and does not normally cropout.

Qg- Granitic Alluvium (Quaternary): Weathered granitic sand.

Reno NE Quadrangle

Qm- Alluvium of Military Road (Holocene): Yellowish- to reddish-brown, poorly sorted granular sand to pebbly muddy sand derived from Qpf. Grades from pebbly deposits in southwest to sands at distal edge near Lemmon Valley playa.

Qpf- Alluvial-fan deposits of Peavine Mountain (Pleistocene): Reddish-brown to dark-yellowish-brown, poorly to very poorly sorted, poorly bedded muddy sandy pebble gravel. Commonly forms multicolored desert pavement composed primarily of altered andesite pebbles, arkosic sand, and lesser amounts of jasper, quartz, and metavolcanic clasts. Well-developed argillic soil. Forms thin veneer overlying Ts.

Qas- Alluvium of Stead airport (Pleistocene): Reddish-brown, very poorly sorted, arkosic pebbly muddy sand derived from Qpg and Qpf. Moderately developed argillic. Forms thin veneer overlying Ts.

Reno NW Quadrangle

No new deposits

Patrick Quadrangle*

EXISTING CORRIDOR ROUTE

Reno NW Quadrangle

Qpf- Alluvial-fan deposits of Peavine Mountain (Pleistocene): Semi-lithified, poorly bedded and poorly sorted reddish-brown and dark yellowish-orange, slightly muddy sandy pebble to cobble gravel. Clasts are composed predominantly of white altered andesite.

Verdi Quadrangle

Ts- Tertiary sedimentary rocks: Stratigraphically equivalent to Th deposits Light gray to reddish-brown silty sandstone, tuffaceous sandstone, and pebble gravel; gray and yellowish-brown to reddish-brown claystone and siltstone; thin-bedded to massive.

Qfy- Young alluvial fan deposits of Peavine Mountain (Quaternary): Light brown to light grayish-brown muddy, sandy cobble to boulder gravel; angular to subangular metamorphic clasts; poorly sorted; poorly consolidated. Little or no soil development. Forms alluvial apron on northeast flank of Peavine Mountain.

Qfo- Old alluvial fan deposits of Peavine Mountain (Quaternary): Light brown to brown muddy, sandy cobble to boulder gravel; angular to subangular metamorphic clasts; poorly sorted; moderately consolidated. Contains brown to reddish-brown argillic B horizon 0.6-1.0 m thick.

Qpf- Alluvial-fan deposits of Peavine Mountain (Pleistocene): Reddish-brown to yellowish-brown clayey pebble to cobble gravel, clayey pebbly sand, and clayey sand; angular to subangular metamorphic clasts; very poorly sorted; moderately to well consolidated. Consists of dissected linear remnants with strong reddish-brown argillic B horizon 0.5m thick. May be montmorillonitic.

Reno Quadrangle

Qpf- Alluvial-fan deposits of Peavine Mountain (Pleistocene): Poorly sorted, pale yellowish to reddish brown, montmorillonitic, gravelly to sandy and clayey silt. White silicified andesite fragments common. Black Springs area- pale orange brown clayey and gravelly sand.

Mzgd- Granodiorite (Mesozoic): Gray hornblende-biotite granodiorite. Deuteric alteration has commonly formed actinolite and chlorite from hornblende and biotite; epidote, calcite and sericite partially replace plagioclase. Not normally deeply weathered and usually forms numerous outcrops.

Qg- Granitic Alluvium (Quaternary): Weathered granitic sand.

Tg- Granitic Stock (Tertiary): Granitic stock. Hypabyssal stock composed of several intrusive phases ranging in composition from pyroxene diorite through granodiorite porphyry to pyroxene syaenite. Largely altered to cream-colored iron-stained rock made up of quartz, sericite, and clay. Locally contains chlorite, epidote and potassium feldspar. Pyrite is abundant in unweathered parts of the altered rock.

Ta- Alta Formation (Tertiary): Dark brown pyroxene andesite flows, flow breccia, and laharic breccia. Commonly altered to tan rock composed of quartz, sericite, and clay minerals or propylitized to gray green rock containing chlorite, calcite, albite, epidote, and clay minerals.

Qa- Alluvium (Quaternary): Poorly sorted clayey to silty gravelly sand, poorly bedded to unbedded.

Qto- Tahoe Outwash (Quaternary): Boulder to cobble gravel, sandy gravel, and gravelly sand. Contains giant boulders. Rock clasts are rounded to subrounded and, in decreasing order of abundance, are granitic, volcanic, and metamorphic.

Vista Quadrangle

Qagy- Alluvial fan deposits of the Pyramid Lake Highway (Holocene): Deposits derived from altered volcanic and unaltered granitic rocks of the Wedekind Hills and the range separating Sun Valley and Spanish Springs Valley; generally poorly sorted, subangular to subrounded clasts. Brown, granitic, pebbly sand. Soils have A-C to cambic B profiles.

Qavo- Alluvial fan deposits of the Pyramid Lake Highway (Quaternary): Deposits derived from altered volcanic and unaltered granitic rocks of the Wedekind Hills and the range separating Sun Valley and Spanish Springs Valley; generally poorly sorted, subangular to subrounded clasts. Gray, volcanic, sandy, pebble to cobble gravel. Soil has strongly developed argillic B horizon 1.2-1.5m thick.

Qavi- Alluvial fan deposits of the Pyramid Lake Highway (Quaternary): Deposits derived from altered volcanic and unaltered granitic rocks of the Wedekind Hills and the range separating Sun Valley and Spanish Springs Valley; generally poorly sorted, subangular to subrounded clasts. Gray, volcanic, sandy, pebble to cobble gravel; forms thin (<3 m) veneer over Qavo. Soil has strongly developed argillic B horizon 1.2-1.5m thick.

Tab- Bleached Alta Formation (Tertiary): Light colored rocks derived from both hypogene hydrothermal alteration and supergene alteration of hydrothermally altered pyretic rocks. These rocks are typically argillized and consist predominantly of montmorillonite and/or kaolinite. Hydrothermal alteration is time equivalent to TQ.

Tq- Quartz alunite ledges (Tertiary): Resistant ledges composed of quartz, alunite, and minor diasporite, iron oxides and zunyite. Contains pyrite below zone of surficial oxidation.

Qbfy- Basin fill deposits of Spanish Springs Valley (Holocene): Generally fine-grained deposits derived from volcanic and granitic alluvial-fan sources. Light gray to brown, silty, clayey sand and sandy silt and clay. Soils have A_C cambic B profiles.

Tli- Lousetown Formation (Tertiary): Intrusive plugs of basalt and basaltic andesite. Age 6-7 million years.

Qe- Eolian sand deposits (Holocene): Light brown, well-sorted, medium sand; only major dunes or sheets mapped. Inactive; deposits generally have a moderately to strongly developed cambic soil.

Qfvo- Alluvial fan deposits of the Virginia and Pah Rah Ranges (Quaternary): Deposits derived from andesitic, basaltic, and locally, metamorphic rocks of the Virginia and Pah Rah Ranges; generally poorly sorted, subangular to subrounded clasts. Brown sandy to boulder gravel; in Spanish Springs Valley, unit also consists of brown medium sand and is widely veneered by unmapped eolian sand. Soils typically have a strongly developed argillic B horizon 60-100 cm thick underlain by a siliceous and calcareous duripan 60-100 cm thick.

Tl- Lousetown Formation (Tertiary): Flows of platy basaltic andesite and basalt. Flows range from pyroxene andesite to olivine-pyroxene basalt. Flows typically dark gray to black, dark brown on weathered surfaces.

Ta- Alta Formation (Tertiary): Pyroxene, pyroxene-hornblende, and hornblende andesite flows, and pyroclastic flows. Phenocrysts of plagioclase, clinopyroxene, and/or basaltic hornblende in a fine-grained matrix of plagioclase, pyroxene, hornblende, apatite, and magnetite. Flow rocks typically medium to dark gray on fresh surfaces, weathering to brown shades.

Twt- Washington Hill Rhyolite (Tertiary): Rhyolite airfall tuff, pyroclastic flows, waterlaid tuff and tuffaceous mudstone. Equivalent in part to rocks of the Truckee and Coal Valley Formations and the sandstone of Hunter Creek. Age approximately 10 million years.

Griffith Canyon Quadrangle

Qa-Alluvium (Holocene): Holocene alluvium, restricted to valley bottoms and localized portions of arkosic, sand and gravelly sand deposited as sheetwash and wash alluvium in Holocene to modern channels or as broad, low-gradient alluvial plains. Locally contains abundant medium sand reworked from older Aeolian deposits. No soil development except on very localized Holocene terraces, where soil is weak, 10-15 cm, and gray-brown. Includes undifferentiated alluvial fan and colluvial deposits in upland areas.

Patrick Quadrangle*

*No geologic mapping is available for the Patrick Quadrangle; however, a review of scale mapping for the northern portion of the state indicates that the geologic units present in this area are similar to those already described in detail above.